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In Re Application of : **HARRY HEPFNER**

For: **AIR PUMP**

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Description

Air pump

The present invention relates to an air pump according to the preamble of Claim 1.

Bicycle air pumps are typically attached somewhere on the frame of the bicycle. However, this has the disadvantage that these pumps are greatly in danger of theft and, in addition, may frequently fall out of the holders provided for this purpose. Therefore, possibilities have already been sought for stowing the air pumps better. One possibility in this regard is offered by housing the air pump in the saddle post or in the seat tube of the bicycle. Various technologies have been developed for fixing the air pump in the locations cited: Thus, for example, an air pump which replaces the saddle post and is removably connected to the saddle using a threaded screw is described in US 5,499,858. To actuate the pump, the saddle is removed from the seat tube together with the air pump and turned over, i.e., placed on the ground with the saddle first, the saddle simultaneously being used as a foot support during the pumping procedure. The device described has the disadvantage, however, that the saddle is dirtied during the pumping procedure and, furthermore, the device is unhandy, since the saddle remains connected to the air pump. A similar device is also described in US 5,324,174, a saddle suspension additionally being integrated. It is extremely disadvantageous for all of these air pump devices that they must be specially adapted for each bicycle and are not universal usable for all common bicycle and saddle post types.

In addition to housing the air pump on the bicycle, problems also result in the housing of further utensils, such as tools, repair kits, or replacement parts and also in the housing of personal objects. Typically, saddle bags are provided for housing the objects cited. Like the air pump, which is also in danger of theft because of the extremely visible attachment to the frame, the contents of the saddle bags are also in danger of theft, since they may be seen immediately from the outside by every potential thief. As a result, providing better housing possibilities for these has also been attempted. DE 44 20 170 shows a repair kit and tool carrier to be housed in the saddle post tube of bicycles. This carrier has holes and recesses for receiving tools and

tire repair kits. It is inserted into the saddle post and clamped therein. This clamping is achieved in that the cover of the carrier, the closure screw, is turned in an internal thread of the carrier. This closure screw is conically shaped, through which the wall of the carrier is pressed against the inner tube of the saddle post. In addition, an expandable ring may be provided on a groove, which is to prevent slipping in the axial direction. However, fixing the carrier in the saddle post is made more difficult by the screwing procedure, since significant forces must be applied for stable fixing in order to achieve an enlargement of the diameter of the carrier. As a result, the insertion and removal of the tool carrier is complicated, requires some physical force, and takes a relatively long time.

The object of the present invention is therefore to provide an air pump which may be introduced easily, rapidly, and securely into the saddle post of the bicycle and also offers the conditions for housing a complete repair set for flat tires.

This object is achieved by an air pump according to Claim 1. Advantageous embodiments are the object of the subclaims.

The air pump according to the present invention has a deformable element between the cylinder and the air outlet valve, which is movably connected to the cylinder. The diameter of this element may be enlarged in relation to the cylinder by moving the air outlet valve. The element is relaxed when the longitudinal axis of the cylinder and the longitudinal axis of the air outlet valve are at a specific angle, particularly 90° one another. The pumping procedure may be performed in this position, for example. To house and lock the air pump in the saddle post, the air pump according to the present invention is inserted with the handle first into the end opposite the saddle or, more precisely, into its opening. The air pump is inserted in this case until the deformable element is largely in the interior of the saddle post. By folding over the air outlet valve so that the longitudinal axis of the cylinder and the longitudinal axis of the air outlet valve run parallel to one another and/or are congruent, the deformable element is compressed, so that its diameter enlarges. The diameter is enlarged in this case until it corresponds at least to the internal diameter of the saddle post. The air pump is thus clamped in the interior of the saddle post. The locking of the air pump in the saddle post may thus be performed easily and rapidly, since less force is required for this

purpose because of the lever effect. Since the element is deformable, it adapts itself to the saddle post, independent of possible irregularities or the precise shape. Since no special thread is required for this fixing, the air pump may be used universally and nearly independently of the diameter of the saddle post. Therefore, special adaptation of the air pump to manufacturer-specific saddle posts is not required; rather, the air pump fits in nearly all common saddle posts. For example, a rubber seal in the form of a rubber disk or even a soft plastic element which may be deformed may be provided as the deformable element.

Furthermore, the handle of the air pump is implemented as a repair tool for the bicycle. Two tool levers are removably connected to the piston rod instead of the typical pump handle for this purpose. As a further embodiment, the tool is slipped over the handle of the piston rod and is removably connected to the cylinder. In this way, both the air pump and also the tool may be stowed in the interior of the saddle post in a compact way. Furthermore, the tool may also remain fixed as the handle in the form of handle shells and may be used in this way, which is particularly advantageous when a relatively large amount of force must be applied using the tool. This is advantageous in the case of tool levers for removing tires, for example.

Finally, a cylindrical container is removably connected to the air outlet valve. This may be performed via a screw or plug-in connection, for example. The cylindrical container in the form of a tube or cup may be filled with diverse objects, such as tools, replacement parts, repair kits, or similar objects. These are thus stored protected in the frame tube of the bicycle.

In the following, the present invention is explained and described in greater detail on the basis of the drawing.

Figure 1 shows an exemplary embodiment of the present invention in a partially cutaway view; and

Figure 2 shows the exemplary embodiment of Figure 1 integrated in a saddle post.

As may be seen in Figure 1 in particular, an air pump 1 according to the present

invention also has all parts of a typical air pump. Thus, a pump cylinder 2 is provided, in whose interior a piston (not shown in greater detail) is moved by a piston rod 3. A handle 4 is provided for moving the piston. Furthermore, an air outlet valve 5 is provided, which is connected to the cylinder 2 so it may pivot or fold, illustrated by the arrow 10. According to the present invention, a deformable element 6, particularly a rubber seal, is provided between cylinder 2 and air outlet valve 5. It may be seen from Figure 2 how the air pump 1 is insertable into the saddle post 50 and connected thereto. The air pump 1 is inserted with the handle 4 first into the opening 52 of the saddle post 50 diametrically opposite the saddle 51. This is performed in the state shown in Figure 1 until the deformable element 6 is located at least just in the interior of the saddle post 50.

By folding over the air outlet valve 5, as illustrated by the arrow 10 in Figure 1, the deformable element 6 is deformed in such a way that its diameter increases; it is more or less compressed in the longitudinal direction. The shortening of the deformable element 6 in the longitudinal direction, illustrated by the sections I' and I", causes an increase of the diameter in the opposite direction, illustrated by d' and d". After enlarging the diameter d' of the deformable element 6, its diameter d" at least corresponds to the internal diameter D of the saddle post 50. The air pump 1 is thus reliably and securely clamped in the interior 53 of the saddle post 50.

To remove the air pump 1 from the saddle post 50, the air outlet valve 5 is folded back into the position shown in Figure 1. As may be seen from a comparison of Figures 1 and 2, the deformable element 6 is relaxed again when the longitudinal axis, illustrated by the dashed line A of the cylinder 2, is approximately perpendicular to the longitudinal axis a of the air outlet valve 5. If the air outlet valve 5 is now pivoted around the joint 7 in arrow direction 10, the longitudinal axes A and a run approximately parallel to one another, and/or are congruent with one another. As a result, the clamped state shown in Figure 2 is achieved.

To achieve the length shortening and diameter enlargement of the deformable element 6, the air outlet valve 5 is equipped with a rounded end 8 which is diametrically opposite the air release end 9. The spacing of the outermost point 11 of the end 8 from the joint 7 is greater than the spacing of the side 12 of the air outlet valve 5 from the

joint 7. As a result, the spacing between deformable element 6 and joint 7 is enlarged by the movement in the arrow direction 10, through which the deformable element 6 is compressed.

After the air pump 1 is inserted into the saddle post 50, the air pump 1 and the saddle post 50 are inserted into the frame tube 60, illustrated by the arrow 61. With the aid of known attachment possibilities, such as a quick-acting clamp, possibly having a lock as theft protection, the saddle post 50 is fixed in a typical way in the frame tube 60. The air pump 1 is now invisibly and securely housed in the interior of the bicycle. To remove air pump 1, the saddle post 50 is merely removed together with saddle 51 from the frame tube 60 and the air outlet valve 5 is folded over, through which the clamp of the deformable element 6 relaxes and the air pump 1 may thus be removed.

In the exemplary embodiment of Figure 1, the handle 4 is implemented as a holder for tools 30, 31 in the form of levers. The tools 30, 31 are connected removably to the piston rod 3, via a thread (not shown), for example. To actuate the air pump 1, the tools 30, 31 advantageously remain as the handle 4 in the form of handle shells. If the tools 30, 31 are to be used, they are removed from the piston rod 3 and used. Alternatively to this, the tools 30, 31 may be slipped over an extension of the piston rod 3, which is then used as a handle for actuating the piston rod 3, and removably connected to the cylinder 2 of the air pump 1. This may be removably connected by a thread provided on the cylinder 2, indicated in Figure 2 and provided with the reference number 14. In this case, the tools 30, 31 are removed from air pump 1 so that it may be actuated for a pumping procedure.

As a further alternative, the tools 30, 31 are also attached via one end of the piston rod 3 and are connected via the thread 14 to the cylinder 2. To actuate the air pump, the tools 30, 31 are removed from the thread 14 through a rotational movement, but remain on the piston rod 3, in contrast to the exemplary embodiment described above, and are then again used as a handle 4. Finally, a cylindrical container 20 is additionally provided in Figure 1, which may be removably connected to the air outlet valve 5, illustrated by the arrow 25. This connection may be produced via the screw connection shown in Figure 1, for example. As may be seen from Figure 2, the air pump 1 according to the present invention, having tools 30, 31 and container 20, may

largely be housed in the interior of the saddle post 50, inserted into the frame tube 60, and thus stowed as a whole in the interior of the bicycle as a repair kit for flat tires.